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*December 09, 2004*

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

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Certified by



Jon W Dudas

Acting Under Secretary of Commerce  
for Intellectual Property  
and Acting Director of the U.S.  
Patent and Trademark Office

17302 U.S. PTO  
60/514556

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**PROVISIONAL APPLICATION FOR PATENT COVER SHEET**

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 C.F.R. § 1.53 (c).

Filing Date		October 27, 2003		Docket No.		3900-0215P	
INVENTOR(s)/APPLICANT(s)							
Given Name (first and middle (if any))		Last Name		RESIDENCE (CITY AND EITHER STATE OR FOREIGN COUNTRY)			
Ranjit Shayne D. Brian A.		MALIK SPENCE HARKINS		York, Pennsylvania New Freedom, Pennsylvania York, Pennsylvania			
<input type="checkbox"/> Additional inventors are being named on the separately numbered sheets attached hereto							
TITLE OF THE INVENTION (280 characters max)							
POLY (ALKYLENE OXIDE) POLYMER - BASED PRESSURE SENSITIVE ADHESIVE AND TAPES FORMED THEREFROM							
CORRESPONDENCE ADDRESS							
Birch, Stewart, Kolasch & Birch, LLP or Customer No. 02292 P.O. Box 747 Falls Church							
STATE		VA		ZIP CODE		22040-0747	
				COUNTRY		U.S.A.	
ENCLOSED APPLICATION PARTS (check all that apply)							
<input checked="" type="checkbox"/> Specification		Number of Pages: 22		<input type="checkbox"/> Application Data Sheet. See 37 CFR 1.76.			
<input type="checkbox"/> Drawing(s)		Number of Sheets: _____		<input checked="" type="checkbox"/> Other (specify): <u>Assertion Claiming Small Entity Status</u>			
METHOD OF PAYMENT (check one)						PROVISIONAL FILING FEE	
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27.						<input checked="" type="checkbox"/> Small Entity (\$80.00)	
<input type="checkbox"/> A check or money order is enclosed to cover the Provisional filing fees.						<input type="checkbox"/> Large Entity (\$160.00)	
<input type="checkbox"/> The Commissioner is hereby authorized to charge filing fees and credit Deposit Account Number 02-2448, if necessary.							

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.☐ Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

BIRCH, STEWART, KOLASCH &amp; BIRCH, LLP

Date: October 27, 2003

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## **PROVISIONAL PATENT APPLICATION**

### **“Poly(alkylene oxide) polymer – based Pressure Sensitive Adhesive and Tapes Formed Therefrom”**

This invention relates to a novel pressure sensitive adhesive based on the poly(alkylene oxide) polymer and radiation cure process. Poly(alkylene oxide) has been used in the past to formulate adhesives, coatings, and release liners. However, the use of poly(alkylene oxide) as a radiation curable pressure sensitive adhesive is a novel application. This invention also relates to the manufacture of pressure sensitive adhesive tapes using radiation cure.

Pressure sensitive adhesives made from poly(alkylene oxide) are desirable because this material is very soft and conformable. Very low lamination pressure to achieve high quality lamination and the ease of removability are two unique attributes of this invention. Its ability to virtually self apply itself to smooth surfaces enables its use in several application areas where pressure sensitive adhesives have not been used before with success.

One such area pertains to a self adhesive interface material to couple two fragile elements of a device, under little or no pressure. An example of the device can be, but is not limited to, an optical light guide assembly. One such specific example is the coupling of a touch screen to the LCD panel. In this embodiment, the coupling material should have, excellent light transmission, form a bond with minimal air entrapment, allow repeated removability for work up, have enough

bond strength to withstand the weight of the touch screen, and resist displacement under normal handling. Optical assembly applications should also meet the criteria for optical clarity, high shear resistance, clean removability, easy repositionability, and be silicone-free. It is an object of the present invention to create an adhesive system that will offer the above mentioned characteristics in a cohesive pressure sensitive adhesive film form.

Previous approaches where poly(alkylene oxide) has been used in pressure sensitive adhesive compositions have relied on either thermal or moisture cure chemistry. Both these chemistries require elevated temperatures or extended cure cycles to convert the formulation to a pressure sensitive adhesive. Certain heat sensitive materials and substrates cannot withstand the temperature required in the curing reaction. The thermal reactions are relatively slow which requires long ovens and/or long curing time for the reaction. Long cure cycles are at a competitive disadvantage in a commercial manufacturing environment. In contrast, radiation does not rely on heat for the curing reaction. Heat sensitive substrates that are difficult to process thermally can be easily used in radiation curing. Radiation curing is also a fast process. Therefore, the curing oven length is short resulting in floor space saving and increased productivity.

Poly(alkylene oxide) is used in the prior art to make self-adhesive hydrogels. Hydrogels contain water as a solvent in its composition. This water remains trapped in the matrix of the adhesive. However, water tends to evaporate

with time leading to drying of the hydrogel and loss in properties. Also, the presence of water in hydrogels is detrimental to the applications discussed above. Therefore, hydrogels are ill-suited for use in these applications.

Known prior art includes the following:

Japanese patent No. JP 01275684 describes a mixture of siloxanepolyoxyalkylene and an acrylic polymer in a pressure sensitive adhesive composition. This patent describes a moisture cured composition.

Japanese patent No. JP 03122180 relates to a pressure sensitive adhesive tape with high elongation and strength. The adhesive dimethoxysilyl group containing propylene oxide polymer is solvent casted. The adhesive is a moisture cured composition and requires thermal energy for cure.

European patent No. EP 894841 describes a polyurethane pressure sensitive adhesive prepared from polyols and diisocyanates. However, the composition discussed requires thermal initiation.

European patent No. EP 295330 relates to an acrylic pressure sensitive adhesive which contains polypropylene glycol. In contrast to the present invention, this patent describes a moisture cured composition that is cast from solvent.

US patent No. 5,319,020 describes an emulsion pressure sensitive adhesive formed in the presence of polyalkylene oxide using a thermal initiation technique. This pressure sensitive adhesive is not curable and is designed to re-disperse in water.

US patent No. 4,707,532 relates to the copolymerization of blocked polyisocyanates containing poly(propylene oxide). However, the disclosed composition requires thermal initiation.

Japanese patent No. JP 59-170168 relates to a pressure sensitive adhesive containing poly(propylene oxide). However, it is a moisture cured system and requires thermal initiation. It also requires the composition to be cast out of solvent.

Japanese patent No. JP 59-074149 describes a curable resin composition containing polyethers. The patent describes a thermal curing composition cast from solvent containing formulation.

Japanese patent Nos. JP 58093774 and JP 57109878 describe a thermally curable pressure sensitive adhesive using polyoxypropylene glycol and isocyanate.

Japanese patent No. JP 57109877 relates to pressure sensitive adhesives containing polyether diols. This patent describes an isocyanate based thermal cure composition.

Japanese patent No. JP 3-118431 describes the use of a polymeric gel for use as an interface material between the touch panel and the display. The patent further discloses that the gel material is comprised of polyurethane.

Japanese patent No. JP 2003-238915 describes the use of a double-sided pressure sensitive adhesive for the bonding of touch panel to the display screen.

The composition of the present invention is novel because it makes use of radiation to bring about the curing reaction. In contrast to thermal curing, radiation is a relatively low temperature curing technique. Heat sensitive substrates which are difficult to process thermally can be easily used in radiation curing. Another advantage of radiation curing is that it is a fast curing process. Radiation cure is over in a matter of seconds whereas thermal and moisture cure can take hours for completion therefore, offers process advantage.

Applications envisioned for the present invention include, but are not limited to, display markets, advertising markets, protective coatings, and transparent label markets. Radiation curing of poly(alkylene oxide) allows the adhesives to be coated free of solvent or water. Also, the adhesive can be coated directly on the delicate heat sensitive substrates. Radiation curing of poly(alkylene oxide) offers logistic advantage in manufacturing.

One specific application involves the bonding of flat panel displays and more specifically the bonding of touchscreens to the glass of a liquid crystal display screen. The application process calls for minimal pressure to protect the delicate screen components. Additionally, it will be possible to remove the touchscreen from the LCD for repositioning or repair. The rigidity of the two substrates will require an adhesive that can easily form bonds between the screens without the need for sustained pressure and yet be cleanly removed for rework.

This adhesive film may also serve as a protective coating during the shipment of the screens between manufacturers.

Another application involves the bonding of graphic displays in the form of rigid, display advertisements. The adhesive film would be applied to a rigid display screen that would then be applied to a smooth surface such as a window or a wall. These display screens could be preprinted with advertisements or act more like a projection screen whereby images could be projected directly onto the screen. This application would require the ability to bond two rigid substrates with minimal pressure to ensure complete contact between the substrates for optimal visual characteristics. The bond would need to withstand high shear stress, yet still be removable for repositioning of the screen or replacement of the advertisement.

Another application of the pressure sensitive adhesive tape involves the protection of delicate surfaces during processing, shipping or repairs. The adhesive would be coated onto film substrates and then cut to fit the shape of the material. The material could then undergo additional processing, shipping or repair work without the possible scratching or scuffing during the work. Envisioned materials could include, but are not limited to, display screens such as cell phones, pda's, televisions, polished surfaces such as aluminum or finished surfaces such as woods, plastics and metals. The delicate nature of the materials dictates the need for an adhesive that will bond to the surface with minimal



pressure and remain in place under shear stress yet be cleanly removable after the process or work is complete.

Another application would be in the manufacture of a clear label for plastic or glass containers for the purpose of a transparent look on the container. The adhesive's ability to bond under minimal pressure will allow for maximum surface wetting of the contoured container. This characteristic again lends itself to fast production speeds be it during in-line application or post-production labeling.

A further application would be in the processing of small fragile components during manufacturing. Typically, small components such as computer chips and semi-conductors need to be held in place while a processing step is carried out. This processing step could be the etching of small components or bonding small components together to form a final assembly. The pressure sensitive adhesive tape would be used to secure the small components in place during the processing. Following the processing steps the components could be cleanly removed from the PSA tape and placed in the final product. This application requires very high shear strength coupled with low peel strength in the form of a cleanly removable adhesive film.

Current offerings of pressure sensitive adhesives are not suitable for use in the above listed applications. Therefore, these applications are being served with either liquid adhesives, or gels. Liquid adhesives require a very slow application process followed by a curing cycle. Furthermore, the ability to remove and

reposition a liquid adhesive bond is not possible. Outgasing from the liquid adhesive is also a reason for concern in some bonding situations. Flow and oozing of the liquid prior to cure also poses a problem for many of the applications. On the other hand, gel systems exhibit a lack of cohesive strength and load bearing capability. This coupled with their lack of good bond formation makes them undesirable for many of the above mentioned applications.

Pressure sensitive adhesive tapes based on poly (alkylene oxide) chemistry overcome the disadvantages of conventional liquid adhesives and gels. Flexibility of the poly(alkylene oxide) backbone, even at low temperatures, allows the polymer to conform and spontaneously wet out on the substrate surface. The surface characteristic of these pressure sensitive adhesive tapes allow for the adhesive to be bonded and removed from the substrate repeatedly at will for repositioning or rework. Given their nature, pressure sensitive adhesive tapes do not suffer from cold flow or oozing. The adhesive tapes bond more aggressively to substrates than the gel materials. The adhesive tapes exhibit very good high temperature resistance. The ability to create a cohesive pressure sensitive adhesive film, capable of the above mentioned properties, will fill many unmet needs in the adhesive market.

A conventional pressure sensitive adhesive has to be rolled onto the substrate with some nip pressure to obtain defect free laminations. The rolling process is possible when the substrates are flexible. However, it becomes difficult

to laminate rigid substrates using a roll process. It is here that the material of this invention provides significant advantage. The adhesive tape when contacted with the substrate surface at one point initiates a bondline that travels spontaneously under its own weight to increase the area of intimate contact until the entire substrate is bonded. Full surface coverage takes anywhere from seconds to a few minutes. The ability to form self-propagating bonds is novel to the pressure sensitive adhesive of this invention. A virtually bubble free lamination is obtained without the use of rolls and nip pressure. The combination of poly(alkylene oxide) polymer and the radiation cure process results in novel material properties not achieved in previous approaches.

Also, the invention is novel because it is a radiation curable composition. Previous approaches where poly(alkylene oxide) has been used in pressure sensitive adhesive compositions have relied on either thermal or moisture cure chemistry. In contrast to thermal and moisture cure, radiation is a relatively low temperature curing technique. Heat sensitive substrates that are difficult to process thermally can be easily used in radiation curing. Another advantage is that radiation curing is a fast curing process. Radiation cure is over in a matter of seconds whereas thermal and moisture cure can take hours for completion, thus offering a process advantage.

The pressure sensitive adhesive of this invention is novel because it has the desirable properties of a hydrogel yet it does not contain trapped water in its

composition. The material of the present invention is a pressure sensitive adhesive with the compliance of a hydrogel. This invention combines the characteristics of pressure sensitive adhesives, especially the bond strength, with that of a gel material. Achieving the correct balance in the two behaviors through thermal or moisture cure chemistry is difficult.

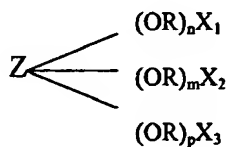
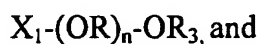
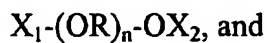
The ability to remove and reposition a traditional pressure sensitive adhesive is also a difficult characteristic to produce on a reliable basis without contamination through transfer of the adhesive to the adherend, and causing permanent deformation in the adhesive tape or the substrate. Therefore, poly(alkylene oxide) extends the spectrum of performance properties beyond that obtained from the conventional polymers known to one skilled in the art of pressure sensitive adhesives.

Furthermore, liquid adhesives fail to address the need for removing and repositioning the adhesive bond. Similarly, during the bond formation the adhesive is uncured and very susceptible to flow and oozing. The gel systems fail to meet the important bond strength and cohesive strength criteria for the applications.

The composition of the current invention is prepared by blending a poly(alkylene oxide) having functional terminal groups with a photoinitiator. Optionally, crosslinkers, tackifiers, plasticizers, and stabilizers can also be used in the blend to optimize the properties. The blend is coated on a substrate using

suitable coating techniques prevalent in the industry and cured using a suitable energy source.

The poly(alkylene oxide) of the present invention having the requisite functional terminal groups may be defined by the formulas:



where  $X_1$ ,  $X_2$ ,  $X_3$  are terminal groups at least one of which permits a curing reaction.  $X_1$ ,  $X_2$ ,  $X_3$  may be same or different from each other,  $n$ ,  $m$  and  $p$  range from 2 to 1000,  $R$  is a straight or branched alkylene group having the formula  $(CR_1R_2)_q$  where  $q$  is an integer from 1 to 4, and  $R_1$  and  $R_2$  may independently be hydrogen and  $C_{1-3}$  alkyl.  $R_3$  can be any organic group the identity of which is immaterial to practice of the present invention.  $Z$  is an organic group that links the three poly(alkylene oxide) chains.

Formation of an optimal pressure sensitive adhesive depends on the crosslink density of the cured poly(alkylene oxide) film. As a general rule, too high a crosslink density will result in a loss of the pressure sensitive adhesive property characterized by peel, tack, and shear whereas too low a crosslink density will result in a loss of the cohesive property. The crosslink density, in turn, will

depend on the molecular weight and functionality of the uncured poly(alkylene oxide). The crosslink density will also depend on the mole ratio of the crosslinker in cases where an external crosslinker is added. The optimal crosslinked density can be established after experimenting with the molecular weight of the uncured poly(alkylene oxide), and the crosslinker ratio. A non-tacky film is obtained if operating outside the pressure sensitive window. Typical molecular weight and crosslinker ratio is given in the example. A blend of poly(alkylene oxides) can also be used to lower the overall functionality in order to control the crosslink density.

Exemplary alkylene groups include but are not limited to - CH<sub>2</sub>CH<sub>2</sub> -, - CH(CH<sub>3</sub>)CH<sub>2</sub> -, - CH(CH<sub>2</sub>CH<sub>3</sub>)CH<sub>2</sub> -, - CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub> -, - CH(CH<sub>3</sub>)CH(CH<sub>3</sub>) -, - C(CH<sub>3</sub>CH<sub>3</sub>)CH(CH<sub>3</sub>) -, and - CH<sub>2</sub>C(CH<sub>3</sub>)<sub>2</sub> -.

Exemplary R<sub>3</sub> groups include but are not limited to methyl or an ethyl group.

The functional groups X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> can be reacted by condensation, addition or ring opening reactions. These are called self-crosslinking systems. Exemplary self-crosslinking X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> terminal groups include, but are not limited to, acrylate, methacrylate, epoxy, vinyl ether, and propenyl ether. Alternatively, terminal groups X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> may not be capable of self-crosslinking. In this case, an external crosslinking agent capable of reacting with X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> is added. The choice of crosslinker will depend on the particular terminal group. For instance, if

the terminal groups  $X_1$ ,  $X_2$ ,  $X_3$  are hydroxyl groups, then an epoxy group-containing crosslinker can be used.

The radiation-cured polymer comprises from about 35 to about 85 percent by weight of polyether segments.

The requisite curing reaction can occur by means of photoinduced reactions of the terminal groups. The class of reactions can range from cationic to anionic to free-radical. One skilled in the art can determine suitable photoinitiators, crosslinkers, and reaction conditions.

In the present invention the term "radiation" means light rays, such as ultraviolet and visible rays, or ionizing radiation such as electron beam.

Preferably, ultraviolet lamps are used which emit UV light in the wavelength range absorbed by the particular photoinitiator used. These include medium pressure mercury lamps and low intensity fluorescent lamps, each having various emission spectra and emission maxima between 240 and 400 nanometers.

Commercially available microwave powered lamps available from Fusion UV Systems may be used.

If the composition is cured by exposure to non-ionizing radiation, such as by UV radiation, then a photoinitiator is also present. The photoinitiator, if present, is employed in a concentration of from about 0.1 to 10 weight percent, preferably from 0.5 to 5 weight percent based on the weight of the crosslinking compound.

The photoinitiators which are employed are well known to those skilled in the art. Such photoinitiators include but are not limited to onium salt photoinitiators of the formula  $Ar^+MF_6^-$  where Ar is a mixed aryl sulfonium or mixed aryl iodonium and M is phosphorous, arsenic or antimony. Exemplary photoinitiators include triarylsulfonium complex salts (U.S. Patent No. 4,231,951); aromatic sulfonium or iodonium salts of halogen-containing complex ions (U.S. Patent No. 4,256,828); aromatic onium salts of Group IVA elements (U.S. Patent No. 4,058,401 and 4,138,255).

A typical free radical system will consist of a poly(alkylene oxide) where  $X_1, X_2, X_3$  are acrylic groups. These groups can be crosslinked in the presence of a free-radical initiator and radiation. Typical free-radical initiators can be selected from either the class of  $\alpha$ -cleavage or hydrogen abstraction initiators. Exemplary  $\alpha$ -cleavage initiator would be hydroxycyclohexyl phenyl ketone and benzyl dimethyl ketal. Exemplary hydrogen abstraction initiator would be benzophenone and isopropylthioxanthone.

The identity of the crosslinking compound is not critical to the practice of the claimed invention. A variety of crosslinking compounds can be used, with the poly(alkylene oxide) and the crosslinking agent each having functionally compatible terminal groups. Crosslinking agents may be either mono- or difunctional. The identity of the crosslinking compound is not critical to the practice of the present invention.



For example, organic compounds having an oxirane ring can be used as a crosslinker when the  $X_1$ ,  $X_2$ ,  $X_3$  groups are hydroxyl. Oxirane ring materials include monomeric epoxy compounds and epoxides of the polymeric type and can be aliphatic, cycloaliphatic, aromatic or heterocyclic, as well as mixtures thereof. These materials generally have, on average, at least 1 polymerizable epoxy group per molecule, and preferably at least about 1.5 polymerizable epoxy groups per molecule. The polymeric epoxides include linear polymers having terminal epoxy groups (e.g., a diglycidyl ether of a polyoxyalkylene glycol), polymers having skeletal oxirane units (e.g., polybutadiene polyepoxide), and polymers having pendant epoxy groups (e.g., a glycidyl methacrylate polymer or copolymer).

Exemplary epoxy-containing materials include those which contain cyclohexene oxide groups such as the epoxycyclohexanecarboxylates, such as 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexanecarboxylate, 3,4-epoxy-2-methylcyclohexylmethyl-3,4-epoxy-2-methylcyclohexane carboxylate, bis(3,4-epoxycyclohexyl)adipate and bis(3,4-epoxy-6-methylcyclohexylmethyl)adipate.

One skilled in the art can readily determine the identity of suitable epoxy compounds for use in the present invention. Reference is made to U.S. Patent Nos. 3,117,099 and 3,018,262 in this regard, herein incorporated by reference.

When employed, the molar ratio of crosslinking compound to poly(alkylene oxide) ranges from about 0.5:1 to about 150:1.

In a preferred embodiment, an epoxy crosslinking compound is reacted with poly(alkylene glycol) to form a pressure sensitive adhesive. The mixture is coated on a flexible substrate to form a coating. The coating is exposed to the radiation source for a period of time (e.g., 1 second to 10 minutes) sufficient to result in crosslinking of the poly(alkylene oxide) whereby the pressure sensitive adhesive tape is formed. The period of time required is dependent upon the type of reactants and the photoinitiator employed, the distance of the radiation source from the coating, etc.

Optionally, tackifiers and plasticizers may be added to the adhesive mixture to modify the adhesive properties. An example of a formulation is given below.

Example 1

Multranol 3900	40 parts
UVR6128	60 parts
Sylvalite RE10L	40 parts
UVI6976	1% by UVR6128

Note: Multranol 3900 is a poly(alkylene oxide) from Bayer Corporation

UVR6128 is an epoxy compound from Dow Chemical Company.

Sylvalite RE10L is a tackifier from Arizona Chemicals.

UVI6976 is a photoinitiator from Dow Chemical Company.

A tape prepared from this formula exhibited a peel value against glass of 25-35 g/in.

The adhesive tape of the present invention may take many forms. The adhesive coating may be formed on one surface of a suitable backing material with a second adhesive layer being formed on the opposing surface of the backing material. Exemplary backing materials include a variety of polymeric films such as polyvinyl chloride, vinyl chloride-vinylidene chloride copolymer, vinyl chloride-vinyl acetate copolymer, vinyl chloride-acrylic acid copolymer, polyvinylidene chloride, polyolefins, polymethyl methacrylate, polyvinyl alcohol, polyamide, polyimide, polyamideimide, polyesters, polycarbonate, polyurethane, and cellulose acetate. A variety of non-polymeric films may also be employed.

Still further, the adhesive layer may be formed on a release coated substrate so that the adhesive layer can be easily picked up from the substrate and transferred to another surface. Other embodiments may be apparent to those skilled in the art and which may fall within the scope of the invention.

While the components cited in the detailed description above are essential to the invention, and will supply the novel features cited, the following may also be employed within the scope of the invention:

Filler materials such as silicas, wood fibers, calcium carbonate and the like can be used to reinforce the system mechanically providing increased shear and tensile strength. Nickel, steel flakes, silver coated glass spheres, carbon black, and the like can be used to make the materials electrically conductive. Alumina, boron nitride, and the like can be used to make the material thermally conductive.

Nanoparticle silicas and nanoparticle montmorillonite clays have also been found to be suitable fillers for decreasing moisture permeability through film.

On increasing the ratio of the crosslinker to poly(alkylene oxide) and adjusting the photoinitiator one can slow the curing reaction to take place much after exposure to the radiation source. This is called “delay cure.” Delay cure systems are of interest because these provide time after exposure to UV before the composition comes to a full cure.

Sensitizers such as anthracene and perylene may be incorporated into the formulations to allow UV pressure sensitive adhesives to cure under visible light or to extend the wavelength range required for curing. Amine accelerators may also be added to speed up the curing reaction.

Adhesion promoters may also be present in the adhesive composition. For example, conventional materials such as titanates, zirconates, and silicone coupling agents may be incorporated into formulation to improve adhesion to glass and metal substrates.

WHAT IS CLAIMED IS:

1. A pressure sensitive adhesive comprised of at least one radiation cured oligomer and/or monomer in situ on a substrate in the form of a coating, said adhesive comprising an insoluble polymer which comprises a plurality of polyether segments of the formula.  $-\text{CH}_2\text{O}-$ ,  $-\text{CH}_2\text{CH}_2\text{O}-$ ,  $-\text{CH}_2(\text{CH}_3)\text{CHO}-$ ,  $-\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{O}-$ ,  $-\text{CH}_2(\text{C}_2\text{H}_5)\text{CHO}-$ , said segments comprising from about 35 to about 85 percent by weight of said polymer.

2. A pressure sensitive adhesive tape comprised of the adhesive of claim 1 on a flexible web, said coating comprising polyether segments which comprise a plurality of  $-\text{C}_a\text{H}_{2a}\text{O}-$  repeat units, wherein  $a$  is an integer of 1 to 4.

3. A pressure sensitive adhesive tape of claim 2 where the second side of the flexible web is coated with a pressure sensitive adhesive.

4. A pressure sensitive adhesive of claim 1, comprising from about 15% to about 65% by weight of an epoxy containing compound.

5. A pressure sensitive adhesive of claim 1 comprising up to about 50% by weight of an acrylate containing compound.

6. A pressure sensitive adhesive of claim 1 comprising from about 15% to about 35% by weight of tackifier.

7. A pressure sensitive adhesive of claim 1 comprising from about 15% to about 35% by weight of a plasticizer.

8. A pressure sensitive adhesive of claim 1 comprising from about 0.1% to about 3% by weight of an initiator.

9. A pressure sensitive adhesive of claim 4 wherein said epoxy-containing compound is selected from the group consisting of aliphatic epoxides, cycloaliphatic epoxides, and epoxidized vinyl compounds.

10. A pressure sensitive adhesive of claim 6 wherein said tackifying compound is selected from the group consisting of terpene phenolics, rosin derived tackifiers, monomeric alcohols, oligomeric alcohols, and oligomeric glycols.

11. A pressure sensitive adhesive of claim 8 wherein said initiator comprises an onium salt cationic photoinitiator.

12. A pressure sensitive adhesive of claim 8 wherein said initiator comprises a free radical photoinitiator.

13. A light guide comprised of the adhesive of claim 1.

14. A removable pressure sensitive adhesive tape comprised of the adhesive composition of claim 1 used in the assembly of touch screens to liquid crystal display screens.

15. A pressure sensitive adhesive tape comprised of the composition of claim 1 used in the assembly and mounting of removable graphics on a rigid or flexible substrate.

16. A removable pressure sensitive adhesive tape comprised of the composition of claim 1 used in the assembly and mounting of rigid or flexible display screens.

17. A removable pressure sensitive adhesive tape comprised of the composition of claim 1 used as a protective covering for various components during further processing procedures.

18. A pressure sensitive adhesive of claim 1 used in the bonding of transparent labels to glass or plastic surfaces.



PATENT  
3900-0215P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Ranjit MALIK et al. Conf.: Unknown  
Appl. No.: New Group: Unknown  
Filed: October 27, 2003 Examiner: Unknown  
For: POYL (ALKYLENE OXIDE) POLYMER-BASED  
PRESSURE SENSITIVE ADHESIVE AND TAPES  
FORMED THEREFROM

ASSERTION OF SMALL ENTITY STATUS

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

October 27, 2003

Sir:

The above-identified application qualifies for small entity status. This written assertion of small entity status should satisfy the requirements of 37 C.F.R. § 1.27.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By 

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JWH/sh  
3900-0215P

Attachment(s)

# Document made available under the Patent Cooperation Treaty (PCT)

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International filing date: 27 October 2004 (27.10.2004)

Document type: Certified copy of priority document

Document details: Country/Office: US  
Number: 60/514,556  
Filing date: 27 October 2003 (27.10.2003)

Date of receipt at the International Bureau: 20 December 2004 (20.12.2004)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)



World Intellectual Property Organization (WIPO) - Geneva, Switzerland  
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse